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ABSTRACT

This paper describes the experience of the Faculty of Economics at the University of Trento, Italy, in delivering online courses through the Web. The faculty chose to design and build its own system from scratch rather than buy one off the shelf. The paper discusses the considerations informing this decision, and presents the main functionalities of the system, which was built with a server-side approach. There are asynchronous functions provided, such as the ability for the teacher to upload educational materials and for the student to download these materials through the Web. Some interesting synchronous functions built into the system include the teacher-student chat forum and the low-cost videoconferencing tool where a single student can interact with the teacher who is available on-line at the same time. Everything is integrated in a unique, browser-based system accessible from everywhere. The paper also describes some important administrative functions of the system. (Contains 11 references and 5 figures.) (Author)

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An alternative system to deliver and manage online courses through the World Wide Web

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Abstract

The paper describes the experience of the Faculty of Economics at the University of Trento, Italy, in delivering online courses through the Web. The faculty chose to design and build its own system from scratch rather than buy one off the shelf. We discuss the considerations informing this decision, and present the main functionalities of the system, which was built with a server-side approach. There are asynchronous functions provided, such as the ability for the teacher to upload educational materials and for the student to download these materials through the Web. Some interesting synchronous functions built into the system include the teacher-student chat forum and the low-cost videoconferencing tool where a single student can interact with the teacher who is available on-line at the same time. Everything is integrated in a unique, browser-based system accessible from everywhere. We also describe some important administrative functions of the system.

1. Introduction

Web-based instruction has become a convenient education medium [Aggarwal 2000]: course offerings using web-based instruction are very common in universities [Teare et al, 1999], even if the opportunities for and means of student-teacher interaction can vary with the programme. This paper describes the development of an interactive online teaching system at the University of Trento, and reports the results of the first experiment with course development and delivery in the Faculty of Economics. The faculty has about 3000 students and more than one hundred teachers, some of whom come from other faculties. At present, few teachers have their educational material available online. Some teachers in the Faculty of Economics took the initiative to produce their educational material in electronic format, and created their own personal Web sites with the syllabus of the course, the slides of the lectures, and the information related to practical aspects of the course (room, timetable etc.). However, each of these Web sites had its own design and logic, resulting in a confusing array of links, material, format of lessons, and overall structures that students had to sift through in order to find the desired information. The plea arose from the students for a more uniform presentation of online educational materials and for a standard procedure to access them.

On this basis, in September 2000 the faculty decided to fulfil this request for uniformity. Firstly, we determined which functionalities should be provided and then looked into whether such a system could be found on the market or should be built from scratch. We will briefly discuss this latter issue. At the evaluation stage it was important to investigate the cost of building a system using internal resources. This was because, although there are valid reasons for purchasing an off-the-shelf Course Management System such as TopClass, Lotus Learning Space or WebCT, there are many instances where universities have successfully developed a system by themselves. It was evident that homegrown systems are often more tailored to a university's specific needs. For an analysis of this, see [A'herran 2001] [McMahon et al, 2000]. Courseware management systems are being promoted as a means of simplifying the creation and management of instructional Web sites. There are many studies that compare specific courseware management tools (e.g. [InfoWorld, 1998], [PC Week, 1997]), but it seems that the efficiency and effectiveness of these tools with respect to customized Web-based systems is less easy to measure.

In summary, we decided to build rather than to buy for the following reasons:

- the cost: the systems that manage, distribute and maintain the online learning materials are high-cost systems that also imply secondary costs for adequate hardware and assistance.
- the skills: the faculty has no personnel specifically qualified to work in these environments. Complex systems such as Lotus LearningSpace™ or Blackboard™ require personnel specifically dedicated to their management, thus requiring more resources than the faculty can provide.
- the highly specific needs of end-users, in particular the integration with administrative and bureaucratic functions: many of the functionalities that normally relate with the didactic activity of the teacher are closely related with administrative tasks that should be carried out in a specific way and at a specific time, thus constituting a big constraint for packaged systems that have no personalization features or that require a vast amount of adjustments in order to be personalized.
- the time: a prototype was to be ready for the second part of the 2000 academic year (March 2000) with a pilot group of teachers and students, and a beta version of the system was to be available for use by all the teachers and the related students in the first semester of 2001. This schedule was not compatible with our time of implementation of already-built learning environment like the ones cited above.

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For all these reasons, we decided to build the system on our own, creating only what we needed. The main objectives of the project were the following:

- to allow the teacher to keep a constant relationship with students, in the different ways that we will explain in the following sections;
- to allow the teacher to distribute educational material to students;
- to keep data for administrative and reporting tasks that must be performed by the teacher and by the secretary of the Faculty.

Some general considerations must be kept in mind to understand the complexity of the relationships among the different entities of the data schema. We have the following constraints:

- A teacher can have multiple courses.
- More than one teacher could teach a course.
- A student can follow multiple courses, and therefore must have access to the different faculty areas of the teachers.
- The educational material must be kept online over a period of some years, in order to let students download the correct material for the year they followed the course, and also to give another possibility to students who have failed to complete their courses within the prescribed time.

A difficult choice, currently under debate in many institutions, regards whether the system should be open to everyone or limited to only registered students, i.e., only regular, fee-paying students. Some teachers believe that the educational material should be freely distributed to everyone in the world, while others prefer that only their students (freely) download the educational material. For the time being the more restrictive vision has been adopted: the students must register with the system by providing their personal data and their faculty registration number. A login and password is released for newly registered students. The same registration procedure is used for the teacher, thus assuring that only the course instructor can load material into the system.

The system is built with several functions, most of which are available to the teacher, a subset is available to the student, and a specific set of functions are devoted to administrative purposes. There are also common functions, though with different privileges: teachers can modify the data while students can only read them. We will now present these functions, distinguishing them by type of user. The main function that the system guarantees is to transfer a file from the teacher's computer to the system, and from the system to the students' computer. By inserting the correct login and password, the teacher can upload the files, categorize them and assign them to the different lessons. The students can work from their home workstations to connect to the system as long as they have a login and password. They can then check for updated information or materials for a their courses, and download the relevant materials if desired. The didactic material or administrative information is thus transferred to the student, who can then read, print, or store it as desired. At the moment, the graphic layout of the Web site has not been decided. When all the functionalities of the system have been completed, the designers will look more closely at the "cosmetic" aspects of the site.

2. The Teacher tools

The teacher is the user having access to almost all the functions of the system. After having inserted her own login and password, the teacher chooses the course on which she wants to operate. Courses are also identified by year, so the course entitled "Information Systems" taught in 1999 is found in a different section with respect to the same course taught in 2000, even if it uses the same educational material.

After having chosen the course, the teacher has all the tools at her disposal. All the tools provide the principle functions for managing the material or information, i.e., inserting, updating, deleting and listing. These tools are principally:

- Materials (lecture slides, tests, solutions of tests, notes, graphics, charts, tables etc.) are categorized, the list of types of materials is dynamic.
- A dynamic syllabus, where the educational material can be viewed. The teacher can upload and download material at this location.
- The course programme, timetable and bibliography of related material.
- "Live" links related to the course, dynamically updated by the teacher and directly usable by students.
- Frequently Asked Questions related to the topics covered in the course.
- The diary of the lessons (fig. 1), which differs from the syllabus in that it has a more administrative organization, while the syllabus can also be used to upload/download the materials.
- The newsgroup, up to three for each course: the details are discussed in the next section.
- The list of the students that are registered for the course, with their email address. The teacher can use it as a mailing list to send cumulative or multiple messages to the students on the list; such messages can refer to lesson cancellation, announcement for seminars etc.
- A videoconferencing system (fig. 2), made using a personalized version of the Netmeeting™ software, integrated inside the browser. When the teacher is online with the videoconferencing system

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File Modulo Database Impostazioni Help F50

Gestione Clienti

Lista dei clienti

Data	Argomento	Note Aggiuntive
1995	Data di nascita	
1996	Data di morte	
1997	Data di nascita	
1998	Data di morte	
1999	Data di nascita	
2000	Data di morte	
2001	Data di nascita	
2002	Data di morte	
2003	Data di nascita	
2004	Data di morte	
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2016	Data di morte	
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2018	Data di morte	
2019	Data di nascita	
2020	Data di morte	
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2095	Data di nascita	
2096	Data di morte	
2097	Data di nascita	
2098	Data di morte	
2099	Data di nascita	
2100	Data di morte	

In the "syllabus" and in the "materials" sections the teacher can upload the material by means of a simple form, just choosing the relevant file from her own hard disk. The system will transfer the file to the server and record the information in the underlying database. In this way, the material is securely transferred to a central station, available for the students to be downloaded. The file is also associated to a specific lesson, thus helping to compile the syllabus. An interesting feature of the uploading process is the possibility of excluding the students from seeing that the file is present on the system. This is very useful in cases where there are multiple teachers on the same course. In fact, the system could be used to create a closed group composed only of teachers and tutors, where some documents are shared only among them and are not visible to the students that enrol for the course. This has been done commonly in courses where tutors and teachers exchanged the test answers before the lesson or test was given.

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The tools available to the students are the same as those seen by the teacher, although mostly in read-only format. In practice this means that the syllabus can be used only to download material from the server, while the course programme can be viewed but not modified. A specific functionality provided to the student is course enrolment (Fig. 3, item 3). As with any enrolment procedure, the student must choose the courses desired. In this area the student, previously registered with the institution, is presented with the list of the courses offered by the faculty that have online materials, and the student simply chooses the courses she wants. However, the most important feature available that is specifically for students is the "news" section. (Fig. 3, item 2)

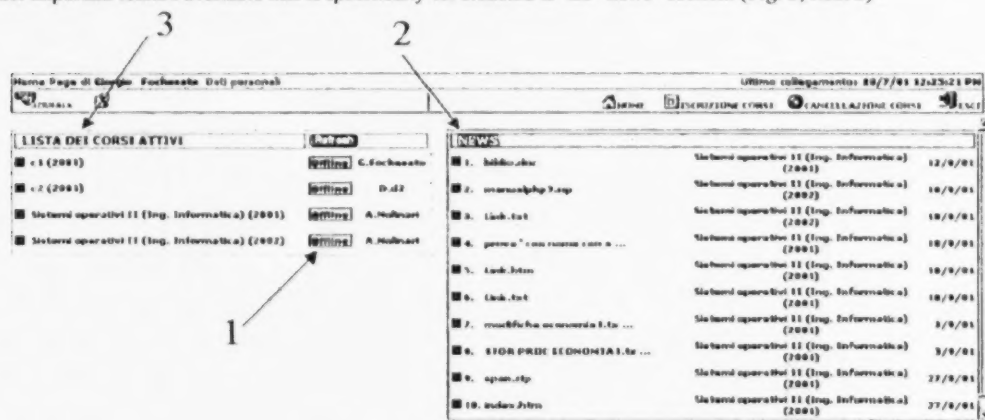


Figure 3: The main window of the student

This function is presented to the student when she connects to the system. On the left is the list of courses in which the student is enrolled, while the right part of the video shows a frame with all the documents uploaded since the last time the student logged in. This feature allows the student to go directly to a document presented in the "news" list without having first to choose a course and search for the most recent material. This is particularly useful to the student who cannot be present in the classroom for one or several lessons but who nevertheless wants to keep up with the course.

Another important feature of the system is the newsgroup. The validity of this tool for didactic purposes has been widely analysed and proved. [Collis et al, 1997] [Eastmond 1995] [Ianna 2000] [Horton 2000] [Palloff et al, 1999]. The newsgroup inside the system is related to the course, thus allowing the teacher to have different discussion forums for every course taught. The teacher moderates the newsgroup by acting on the messages in varying ways: recommending a message, deleting messages, voting on messages etc.. The messages from the teacher are of a different colour (fig. 4), this to confirm the different role of the teacher in managing the newsgroup. Each message, both in the summary and in the detailed view, reports the number of times it has been read by other users (fig. 5, item 1). Students can participate in the forum not only by writing and responding to messages, but also by voting on the messages (fig. 5, item 2).

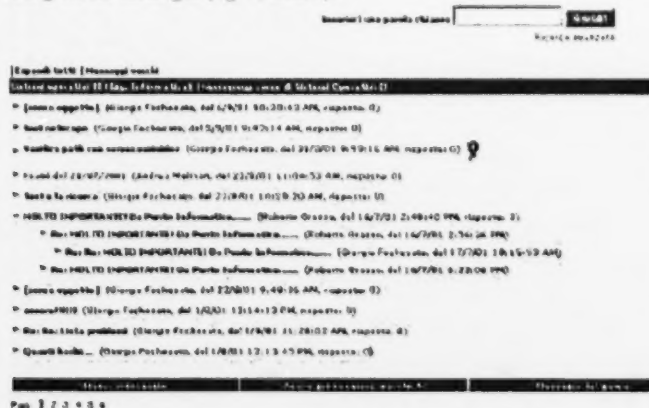


Figure 4: The newsgroup with the different types of messages

This vote is visible to everyone and serves to evaluate the importance of the message for the current topic. The forum has threads, so every reply is associated with the corresponding message. The thread in which the message is involved is always visible to the reader, also when she writes a response. (fig. 5, item 3). All the messages are stored in and appended to text files, not in the database. The files have a preconfigured maximum dimension, so when this dimension is exceeded a new text file is created. This proved to be the most logical choice when taking into account the following facts:

- the number of newsgroups available: there are more than one hundred teachers and courses
- the variable dimension of the messages: in most cases the messages are short (a few hundred characters), but some messages (FAQs, for example) could be very long, so the database fields should be dimensioned accordingly, with a great waste of space.

On these text files an indexing engine makes it possible to use the traditional search and advanced search mechanisms. As mentioned in the discussion of teacher tools, in the student section it is possible to check if the teacher is on-line at that moment via videocamera, and therefore if the teacher is available for interaction in real-time (fig. 3, item 1)



Figure 5: a single message with different options

4. The administrative functions

This area includes several functions, not only related to ICT administration. It also includes functions necessary for the faculty secretary. The first important function is the change of academic year. In September of every year, the course can change teacher/s, title, group of discipline, and most of all students. So, every year in this period a specific function that allows the faculty secretary to redefine the association between the courses and the teachers must be provided. Because of the quantity of information associated with a course, this task requires the provision of several functions that could be fully automated, partially automated or completed manually. These functions are listed as follows:

- A function to transfer automatically all the materials from the previous to the current year, this in case the teacher decides to reuse the material of the previous year. Everything is therefore copied with a new identifier, so the old and the new courses have different identities but the same material.
- A function to selectively transfer materials and other information related to the course from one year to the other. The major problem is represented by the newsgroup, where threads could be in progress and therefore an automatic transfer between the two years could confuse the students on one side, and could be inconsistent with a potentially different course programme on the other. The default option is that the newsgroup remains connected only to its original course, so a new course will have a new newsgroup.
- A function to store previous courses with all the related materials so that students can access to them.

Other more traditional administrative functions are related to the ordinary activity that the secretary carries out during the academic year, especially at the beginning of the year. The main function is the management of the teacher database, with all the administrative information necessary to fulfil bureaucratic obligations. In addition, a function that assigns the teacher to courses is provided; this association is fundamental for the rest of the system, as it is used in every area that grants access to the online material. All the materials, newsgroups, links, students etc. depend on this unique association: teacher-course-academic year.

5. Feedback and future developments

The prototype of CMS we developed has been under a stress test since the second semester of academic year 2000/2001 and will be released in its final version at the end of this experimentation period. The system has

been tested with about 1.600 students and 200 teachers for one year, with a download rate of 1.300 documents per day. We submitted some questionnaires to students, both manually and via e-mail, and collected direct feedback from colleagues. From these responses we can assert that the reaction to the system has been very positive. Our main concern was the teachers with less computer experience, which meant a majority of our faculty. The system has proven very easy and intuitive to use, winning praise from everyone due to its simplicity. We must admit, however, that we made a great effort in this area, in terms of providing direct assistance to teachers, sometimes by using students to help teachers in difficulty. We also received positive comments from the students. In the students' questionnaires we asked for comments on functionality, usefulness, quality of materials and performance of the system.

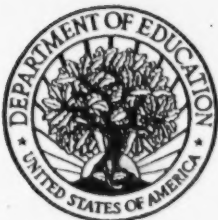
In short, of the approximately 200 questionnaires returned from students, 79% expressed satisfaction with the system. In particular, the contact with the professor and the availability of new material are the most welcome features. Eighty-six percent were satisfied with the quality of the material, although a few underlined the need for open (not read-only) material. The overall usefulness of the system was largely connected to the news section, where the student is notified at every connection of any new material added since his/her last connection. A second positive aspect was the teacher-student contact and the related improvement in the learning process. In this part we received 91% positive feedback, an embarrassing indication that change was definitely needed. The performance of the system was found to be satisfactory for 78% of students, while the rest were not very satisfied. An important point to note is that teachers often don't look at the amount of megabytes their materials represent (they use office connections to the Web site) but students using home connection with analogic modems at 56Kbps suffer in this aspect, which should be considered more by teachers when uploading materials. As regards the frequency of use, more than 50% of students used system daily, and the rest from two to four times a week.

In conclusion, we can be very satisfied by our first experiment, though there are some points where the system must be further integrated. One important point of integration is with the student secretary database. In our university the student secretary is an autonomous entity, with its own procedures, database and technology. On one hand this allows single projects to be started without having to depend on the big infrastructure of the student secretary. On the other hand, however, there is a time where the different autonomous systems should be integrated. The simplest example regards the login and password to access the different facilities that the university offers to students, examples being e-mail, access to laboratories, account of the refectory, etc.. At the moment, the uniformity of login and password in the two systems is not guaranteed, it is up to the student to register herself in both systems with the same login and password.

In conclusion, the system presented in this paper is one alternative to Course Management Systems, built with the main target of distributing educational material to students in a uniform way. Some real-time functions have been added to the system and are currently under testing; however we believe that the basic functionalities provided by the system to distribute dynamic information and educational material are the minimum services that should be provided to students. The positive results of the first experiments seem to confirm this assertion.

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